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Name: Sheet or belt shaped grinding tool, process and fixture for the manufacturing of said grinding tool

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The following printed materials have been researched for evaluation purposes for the determination of whether a patent can be issued.

DT - AS 23 48 338
DT - AS 14 27 591
DT – OS 24 14 047
DT – OS 17 52 612
CH 3 66 212
GB 13 70 853
US 29 85 455
US 24 42 058
US 21 94 472

Patent Claims

1. A sheet or belt shaped grinding tool, consisting of a grinding medium that possesses a ball like shape, and that is attached by means of a common binding medium onto a supporting carrier material, and with which said binding medium consists of an organic binding agent matrix, such as phenolic resin, ureic resin, or polyacrylate, and which possesses a large number of said grinding medium, characterized in such a way that the common binding agent matrix (5) maximally possesses the hardness of the common binding agent (3), and that said binding agent is equipped with pores (7).
2. A grinding tool according to claim 1, characterized in such a way that the number of pores amounts to up to 35 volume percentages of the ball shaped grinding body (4).
3. A grinding tool according to the claims 1 or 2, characterized in such a way that up to 60% of the binding agent matrix is replaced by means of filler materials in order to change the hardness of said material.
4. A process for manufacturing a grinding tool following one of the claims 1 – 3, with which a first binding agent coating is applied to a carrier material, and with which said first coating will be covered by means of ball shaped grinding bodies that are sprinkled onto it, and that will be cured after the application of a second binding agent coating, characterized in such a way that the grinding particles, as well as a liquid matrix binding agent are dispersed in an organic solvent phase, and that they are kept in said dispersion until the ball shaped grinding particles are created that will stabilize their ball shaped condition, and with which subsequently the ball shaped grinding bodies will be separated away from the organic solvent phase, and with which said grinding bodies will be dried, and, if so desired, said grinding bodies will be cured.
5. A process according to claim 4, characterized in such a way that 5 to 40 weight percentages of the binding agent matrix, in relation to the weight of the grinding bodies will be dispersed in the organic solvent agent phase.
6. A process according to the claims 4 or 5, characterized in such a way that the grinding bodies, as well as the matrix binding agent will be dispersed by means of a stirring process, and that they are kept in dispersion by means of said process.
7. A process according to one of the claims 4 through 6, characterized in such a way that a hydro carbon or a hydro carbon mixture will be utilized as being the organic solvent phase.
8. A process according to one of the claims 4 through 6, characterized in such a way that per-chlorine ethylene will be utilized as being the organic solvent phase.
9. A process according to one of the claims 4 through 8, characterized in such a way that aqueous, organic binding agent mixtures will be utilized as being the matrix binding agents.
10. Fixture for the execution of the process according to claim 6, characterized in such a way that a stirring container (9) that is equipped with a stirring disc (13) will be utilized, and with which said disc possesses a diameter that is about ¼ to ½ of the diameter of the stirring container.

The invention is concerned with a sheet or belt shaped grinding tool, consisting of agrinding medium that possesses a ball like shape, and that is attached by means of a common binding medium onto a supporting carrier material, and with which said binding medium consists of an organic binding agent matrix, such as phenolic resin, ureic resin, or polyacrylate, and which possesses a large number of said grinding medium, as well as with a process for the manufacturing of said grinding tool.

A grinding tool of the above mentioned kind can be considered as being known and it can be obtained from the DT – OS 1752612. It is pointed out in this printed document that the grinding bodies consists of a hard bonded conglomerate, in opposition to this, with the presented invention, an elastic material is utilized as the common binding agent. The solidly bonded grinding bodies are supposed to float in the common elastic binding agent, to herewith improve the elasticity of the grinding tool. Recommended as binding agents are rubber varieties that are adjusted to be soft, as well as softened epoxy resins or similar materials, while the binding material matrix of the grinding body itself shall be of a harder nature. Known and mentioned as examples are: ceramic, hydrating natural and artificial resin binding agents. With this kind of grinding tool, the soft embedding masses will be removed continuously together with the grinding particles.

There have been previous experiments to reach economical solutions for the surface treatment of objects by means of changing the grinding particle positioning. For example, there are grinding tools known that are positioned on carrier material supports that are constructed in such a manner that initially a layer of cork or expanded vermiculate particles will be sprinkled onto the first binding agent coating. Subsequently, another coating of binding agents will be applied on top of said initial layer, and the grinding particles will be sprinkled by means of the known sprinkling process into said coating layer, or the grinding particles are already present in the form of a sludge inside of said coating material. The grinding particle layer achieves the desired three dimensional positioning with the support of the under laid carrier particles. However, there is the opinion existing that grinding tools that possess such a construction displayed an increased friction resistance, which even is desirable, for example, with polishing processes. A grinding medium that is constructed in such a manner and that is utilized for polishing purposes is described in the US – PD 2542058.

Furthermore, decades ago the recommendation was made in the US – PD 2194472, to utilize less tenacious bound grinding conglomerates for the production of sheet or belt shaped grinding tools. The tenacity characteristics shall be caused by means of correlation between the kind and the amount of the binding medium. There is no statement made in this printed document about the importance of the binding medium itself. For example, aggregate particles are bonded by means of ceramic binders – which means, a relatively hard binding agent, while glue – which means, a relatively soft binding agent - is utilized for attaching the agglomerates onto the support material. This teaching was never executed in practical application situations. The DT – OS 2414047 describes a ball shaped composite grinding particle material that contains small, fine grinding material particles that are contained in a ceramic binder. Composite materials of such a kind are to be used preferably in situations in which very hard micro particles, such as, for example, diamonds or boric carbide, are to be utilized. The hard ceramic binding will be preferred because of the fact that organic binding agents do not possess the desired hardness.

According to a process that is described in the DT – AS 2348338, thin walled, hollow spheres are anchored onto a supporting carrier material, and grinding particles are fixed on top of said spheres by means of a binding agent. The grinding tools that are produced in such a fashion display higher operation durability if compared to conventional grinding tools that possess a single layered grinding particle positioning. Herewith, it is considered to be an advantage that a hollow chamber is created during the grinding process caused by the breaking of the hollow spheres. The grinding particles are attached to the hollow sphere shaped grinding body by attaching them by means of adhesion to said spheres, with which, for example, material losses can occur that are caused by a concentration of said particles. A specifically advantageous process for the production of hollow sphere shaped grinding bodies is described in the DT – OS 2516008. Herewith, foam like carrier bodies that possess a cell structure, for example, that are made of polystrole, will be surrounded by an excess amount of grinding particles, and they will be heated to such a temperature and for such a time duration that is required for the carrier body to undergo a volume loss of more than 50%. This process causes a very solid anchoring of the grinding particles.

Based on the DT – OS 1752612 the scope of the presented invention is to develop a sheet or belt shaped grinding tool, as well as a process for the manufacturing of said grinding tool that provides a high and homogeneous grinding ability together with a continuously uniform grinding depth without any premature signs of clogging. It shall be tried to position a higher corn density per area unit onto the surface of the carrier material without causing any negative side effects. This should result in an increased durability of the grinding tool, and thus it should increase the economics of using such a tool.

This scope will be solved in such a way by the type of grinding tool that can be utilized for the common technology that the binding medium matrix maximally possesses the hardness of the common binding agent, and that it is also equipped with pores. With this construction, the ball shaped grinding bodies are penetrated entirely by the organic binding medium matrix, and thus, there is a multiple number of grinding particles anchored in the ball shaped grinding body. The organic binding medium matrix moistens the single grinding particles and keeps them together in a ball shaped grinding body with the support of binding medium bridges that are located in-between said particles. It is considered to be of importance that the organic binding medium matrix possesses a uniform hardness with this construction, preferably it should be softer than the common binding agent that is utilized for attaching the grinding body to the supporting carrier material. Herewith, the advantages result in the ball shaped grinding bodies releasing the grinding particles continuously and in a uniform manner without creating the danger at the same time that the surface of the work pieces will be scratched. This will not happen because of the fact that the grinding bodies themselves cannot act herewith like a large super particle. The binding medium matrix contains more or less open and/or closed pores. The ball shaped grinding bodies contain up to 35% of their volume, preferably, 7 to 15% of their volume, of closed pores following a preferred execution example. Preferably, the dry weight of the ball shaped grinding bodies should be between 0.65 and 1.35 g/ml, preferably, 1.15 to 1.25 g/ml, depending on the enclos d components and the kind of process that is applied.

In order to modify the hardness, it is possible to replace up to 60% of the binding medium matrix by means of solid materials. Herewith, it is possible to utilize inert filling mat rials that are known to the experts of this technology, such as calcium carbonate, or

kaolin, and/or grinding active filling materials, such as, kyrolith, or potassium boro.... *(remainder of word not readable, the translator)*.

The hardness of the ball shaped grinding bodies that are produced according to the invention is not very large. It can be influenced within certain limits by means of the appropriate selection of the binding agents that are used for the matrix, as well as by means of changing the porosity. In general, it is possible to rather easily powder the grinding bodies that are produced according to the invention between ones finger tips. In general, the hardest versions can be compared with breaking particles of grinding disks that are bonded with phenol resins, while the softer versions are about comparable with their hardness to hollow sphere shaped grinding bodies that are made of polystrol and that have been mentioned at an earlier point in this document.

The common grinding particles such as, aluminum oxide, silicon carbide, and flint are recommended for the construction of the ball shaped grinding bodies. Suitable as organic binding medium matrix are substances that are commonly used for the binding of grinding particles. These kinds of materials shall possess a strong adherence to the grinding particle, and it shall withstand the friction, impact and pushing forces that are present during the grinding operation. Specifically suitable as organic binding agents are the known phenol formaldehyde resins, ureic resins, or melamine resins, but also other binding agents, such as, for example, plastic material dispersions, specifically polyacrylics. For the purpose of considering the hardness one can in general assume that phenolic resoles can be considered as being the hardest binding agents, and that modified phenolic resins, as well as polyacrylics are considered to be softer than ureic resins. It is of importance herewith that the individual grinding bodies break off as uniformly as possible once exposed to the influence of the pressure forces that are applied during the grinding process. Herewith, mainly the porosity of the matrix, as well as the positioning of the grinding on the supporting carrier material are of importance besides the selection of the suitable binding medium matrix.

For the purpose of the construction of the grinding bodies, it shall be mentioned that the median particle size of the grinding particles shall range between 3 and 500 micron, preferably, between 50 and 300 micron. With this kind of particle fraction it is possible for the ball shaped grinding bodies to have an exterior diameter of up to 500 times that of the grinding particle. An exterior diameter of 5 to 30 times, specifically, of 5 to 10 times that of the median diameter of the grinding particle will be preferred. The ball shaped grinding bodies of a preferred execution version consist of 80 to 97 weight percentages of grinding particles, and of 3 to 20 weight percentages of the organic binding medium matrix. The ball shaped grinding bodies can have diameters of 200 to 3000 micron. However, it is recommended to sift the grinding particle fraction within tighter diameter limits prior to their application onto the supporting carrier material. This should be executed to achieve the optimal result for each application case. As it will be shown later during the explanations for the figure 4, a larger grinding body fraction causes, for example, a faster grinding of the work piece than this is the case with a smaller grinding body fraction. However, the smaller grinding body fraction can lead to a higher durability. It was found that grinding body fractions of 300 to 500 micron, 500 to 710 micron, 710 to 1000 micron, or 1000 to 1500 micron are appropriate. It will be possible by means of the selection of the suitable diameter to achieve a varied breaking of the ball shaped grinding bodies at various application pressure forces while the amounts of the available particles per area unit remain identical. Furthermore, the

grinding tool gains the character of a more or less openly distributed grinding media with the identical particle amounts depending on the selected particle fraction.

The ball shaped grinding bodies will be attached to the support carrier in the generally known manner by applying a first binding medium coating onto a carrier layer, and that ball shaped grinding bodies are subsequently sprinkled onto said first layer, and that the system will be cured after the application of a second binding medium coating. A specifically advantageous process for the manufacturing of a grinding tool is characterized in such a way that the grinding bodies, as well as a liquid matrix binding medium will be dispersed into an organic solvent phase, and that it is maintained in dispersion therein until ball shaped grinding bodies will be created that will stabilize their ball shape by means of the curing process of the matrix binding medium. Subsequently, said ball shaped grinding bodies will be separated away from the organic solvent phase, they will be dried and cured if so required. The expert of the technology understands that creating a dispersion means that added materials such as grinding particles and matrix binding mediums will be distributed in the liquid in a small and as fine as possible manner. It was shown to be of advantage if one first introduces the grinding particles, and if so desired, together with the filler materials into the organic solvent phase, which will be followed by subsequently adding the organic binding medium that creates the said matrix together with any desired filling substances that are dispersed in said medium into said organic solvent phase.

A specifically advantageous process is one with which 5 to 40 weight percent in relation to the weight of the grinding bodies will be dispersed in the organic solvent phase. The amount statements are based on the wet weight of the common binding mediums and they consider that the amount of solid components in said binding mediums range between 45 and 80%. If so required, catalysts such as ammonia chloride oxale acid, hydrochloric acid, or phosphoric acid can be added. Said additives are specifically suitable for the catalytic exhilaration of the curing process of formaldehyde condensation products. The observation of the above mentioned amount relations of organic binding mediums to the grinding particles is an important preset process condition for being able that one achieves ball shaped grinding bodies that consist in their advantageous condition of 3 to 30 weight percentages of the organic binding medium matrix, and for 80 to 97 weight percentages of grinding particles.

Suitable as being an organic solvent phase is any inert organic solvent that can be mixed with water. However, the organic solvent phase should not possess a too low boiling point to allow that the condensation reaction of the binding medium matrix can, if so required, be supported by means of conducting the process at elevated temperatures. Herewith, it is possible to tremendously reduce the reduction times. Depending on the needs, the reduction can be conducted at temperatures that range between 20 and 100 °C. Hydrocarbons or hydrocarbon mixtures are preferably utilized as organic solvent phases. Also shown to be of advantage as organic solvent phase have been halogenated hydrocarbons, specifically per-chlorine ethylene. Per-chlorine ethylene is of advantage because of the fact that it is not flammable, that it possesses an advantageous MAK value of 670 mg/m^3 (MAK = max. working place concentration), that it possesses a high enough boiling point with a relatively high vaporization number, and that thus the insurance is provided that a relatively rapid drying of the ball shaped grinding bodies will take place. Other solvents in which the binding medium matrix of the ball shaped grinding bodies will not be dissolved are, for example, mineral oils that possess a high boiling point, or aromatic solvents, such as the aromatic solvent mixtures

(99% aromatic content; density 0.873; boiling point 160 to 178.7 °C; solidifying point 48.5 °C, and vaporization number 63.5) that are distributed under the brand name "Shelsol A" by Shell-Chemie.

Specifically preferred as organic matrix binding mediums are aqueous binding medium mixtures. This is because of the fact that it was discovered that they develop in the organic solvent phase, for example, in such a phase that is described above, an excellent affinity to the grinding particle, as well as the filling materials that will be added if so desired. The affinity enhances the creation of the ball shaped grinding bodies.

It will be preferred that the grinding bodies, as well as the matrix binding medium will be dispersed and kept floating in the organic solvent phase by means of a stirring process. The stirring process will be conducted for the a time duration that is required for the creation of form stable balls inside of the organic solvent phase. A stirring vessel that is equipped with a stirring disk that possesses a diameter that is ¼ to ½ of the diameter of the stirring vessel is specifically suited for the execution of said process. Herewith, the desired creation of the ball shaped grinding bodies can be specifically well achieved in their floating condition inside of the organic solvent phase. By means of selecting the appropriate stirring speed in combination with the shape of the stirring disk that is displayed, for example, in Fig. 3, one will be able to achieve a specifically advantageous dispersion. For this case, the aqueous binding medium phase will be beaten up into more or less large droplets that will be maintained in a floating condition for such a time duration, for the case that the rotation speed is appropriate, at which a stabilization of the form has taken place by means of the curing process of the resin. It was discovered that the droplets obtain an almost ideal ball shape, and that they are also located in a relatively limited diameter range. The dimension of the balls can be controlled with the support of the stirring speed, as well as by means of the addition of binding medium. The ball shape remains in contact also after the separation away from the organic solvent phase. However, it is possible that larger amounts of ball concentrations that are present with a not fully cured binding media matrix may lead to a deformation of the ball shape that is caused by the weight of said high ball concentration. Herewith, it was possible to observe deviations of the median exterior diameter that were in the range of up to 10% away from the ideal ball shape. An increase of the binding medium content leads at constant stirring speeds to an increase of the average ball diameter. In opposition to this, an increase in the stirring speed at the identical binding medium content leads to a reduction of the average ball diameter. Too high rotation speeds of the stirring disk can lead to the destruction of already formed balls. There is also the possibility present, in combination with suitable rotation speeds, to stir certain amounts of air into the dispersion (introducing) that can be trapped in the shape of small bubbles inside of the grinding bodies. Herewith, it is possible to achieve a limited amount of porosity in the balls that can be executed in relatively narrow borders. A higher amount of porosity can be achieved with the support of adding gassing agents, for example, ammonia carbonate, to the dispersion.

Once the ball shaped grinding bodies are cured enough that they possess the solidity that is required for their safe handling, the stirring will be terminated, and the grinding bodies will be separated from the organic solvent phase by means of the common process technologies, such as, decanting, filtering, or with the support of centrifuging processes, and the organic solvent phase will be reintroduced into the process. If so required, th ball shaped grinding bodies will be washed once more with fresh solvent. This post washing process is recommended for those cases, in which a solvent was

utilized that possesses a high boiling point in combination with a relatively low vaporization number. For such a case one selects a solvent that possesses a relatively high vaporization number for the post washing process to exhilarate the drying process. It is also possible to support the drying process by means of sucking or blowing air through the layer of balls. Herewith, it is also possible to preheat said air. However, it is not advisable to select too high of temperatures herewith, because it is possible that the grinding bodies could form clumps for the case that the binding medium matrix is not fully cured yet. With the utilization of per-chlorine as the organic solvent phase air temperatures of 35 – 50 °C were found to be suitable herewith.

During application of the ball shaped grinding bodies onto the supporting carrier material the following still needs to be observed. Initially, a common binding medium, for example, modified or non modified phenolic resin will be applied to the, in general, belt shaped carrier material, and subsequently to said initial process, the ball shaped grinding bodies will be applied, by means of, for example, gravity enforced sprinkling processes, or electrostatic sprinkling processes. Subsequent to this process, said initial binding medium coating will be dried. Following this drying process, it is preferred that, said initial coating will be over coated with a second binding medium layer, and that herewith the ball shaped grinding bodies will be attached to the carrier material during the subsequent drying process. The second binding medium coating will be applied with a specifically low viscosity. This is in deviation of the operating processes that are otherwise common for the manufacturing of sheet or belt shaped grinding tools. Herewith, it will be achieved that the grinding bodies will protrude freely enough away from the supporting carrier material, and that they are thus not covered too much by the binding medium. This means, that the grinding bodies should not be attached in the second binding medium layer in a floating manner, but that they should be surrounded by said binding medium in a film like fashion only, and that they mainly should be attached to the base. Herewith, there will be open areas remaining in the plane of the second binding medium layer that will have advantageous results with the removal of cuttings. At the same time, this measure will be of advantage for the flexibility of the grinding media towards the supporting structure.

The viscosity of the binding medium mixtures are commonly measured in Centipoise, however the sole statement of the viscosity would not clearly identify the scope of the operating process. This is because of the fact that viscosities are also measured with the conventional grinding media depending on the resin types and processing variations that are utilized herewith. The operating process can be best explained with the support of an example: Ball shaped grinding bodies that possess a diameter of 800 μ that about correlate with the grid size 20 with a conventional grinding media on a supporting carrier material, while ball shaped grinding bodies of the dimension 600 μ about correlate with the grid size 30. For the case that one would apply the initial binding medium coating of a conventional grinding media on a supporting carrier material with a viscosity of, for example, 800 cP, one would adjust the binding medium layer for the ball shaped grinding bodies, following the teaching of the invention, under the same operating conditions also to 800 cP, while the much lower viscosity of 200 cP would be, sufficient, however, for the second binding medium coating. It showed to be of advantage during practical applications to select the viscosity of the second binding medium coating to such a degree that it results in less than half of the viscosity of the initial binding medium coating.

It is of importance that the ball shaped grinding bodies are attached to the supporting carrier material in the appropriate application density. Furthermore, it has to be observed that the binding medium matrix that bonds the single particles that are located inside the ball shaped grinding body is laid out appropriately to accept the forces of the application pressure that are to be expected, and that thus the single grinding particles are connected to each other solidly enough, and that an appropriate connection will be maintained during the grinding process. Because of the ball shaped structure of the grinding bodies, a high grinding particle distribution per area section will be available herewith once said bodies have been attached to the supporting carrier material. By means of changing the diameter of the ball shaped grinding bodies, it is possible, if so desired, to vary the thickness of the grinding particle containing layer without changing the amount of grinding particles per given surface area. For practical applications one will achieve good results in those cases in which 49 to 80% of the surface of the supporting carrier material are covered by means of the ball shaped grinding bodies.

The most important advantages of the grinding media that is produced on top of a supporting carrier material following the invention are:

high and uniform grinding forces across a long time duration;

uniform roughness depth;

high number of particles per surface area unit, and thus a highly economical output of the utilized support material;

even with the high available particle amounts per surface area unit, the flexible characteristics of a grinding media that this supported by means of a carrier material remains in place;

it is possible to influence the applied number of particles per surface, as well as the particle amounts that will be in operation within said surface without influencing one and the other by means of modifying the diameter of the ball shaped grinding bodies;

an individual adaptation to varying application pressure forces can take place with the support of varying the binding medium, the pore volume of the grinding bodies, the diameter of the grinding bodies, or by means of the application density on the supporting carrier material;

because of the fact that the application density on the supporting carrier material can be varied without changing the amount of grinding particles that are present per surface area, it is possible with the here presented grinding material to produce grinding media, without reducing the other advantages, that is supported by a carrier material that is little sensitive against clogging processes, and this can take place without reducing the other advantages of said grinding media;

simple and very economical manufacturing process;

the finer and larger component amounts that are sifted off during the manufacturing process can again be brought back into the production process, and thus there is practically no loss present herewith. The large components will be ground up prior to the reuse. –

With the support of execution examples, the invention will be explained in more detail in the following. Displayed is in

Fig. 1 a grinding media that is located on a supporting carrier material and that is shown in a schematic manner

Fig. 2 a schematic display of the ball shaped grinding body that is shown in an enlarged manner

Figs. 3a – 3c a stirring apparatus that is specifically well suited for the production of said ball shaped grinding bodies

Fig. 4 a diagram of the influence of the different ball diameters onto the grinding output, as well as a comparison with a conventional belt.

Fig. 1 displays the supporting carrier material 1, for example, a woven material that possesses the common first binding medium coating 2, the common second binding media coating 3, and the ball shaped grinding body 4. The figure shows that the second binding medium coating possesses a relatively open structure with which said structure is mainly utilized for attaching the grinding bodies 4 on to the first binding medium coating 2.

The open structure can be seen clearly in Fig. 1. The grinding bodies protrude vertically out of the plane of the common binding medium 3, and herewith it is possible to observe a certain moistening across the entire exterior surface of the grinding bodies. Independent of this specific example, it is preferred in general that the grinding bodies protrude with ¼ through ¾ of their diameter out of the plane of the common binding medium.

The enlarged display in Fig. 4 shows the ball shaped grinding body 4 that is penetrated over its entire cross section by means of the organic binding medium matrix 5 and the individual grinding particles 6. The grinding body possesses pores 7 to a lesser extent.

Fig. 3c displays the stirring installation with the stirring vessel 9 and the stirring shaft 10 that has a stirring disk 13 flanged to it. Contained inside of the stirring vessel is the organic solvent phase 8, as well as the ball shaped grinding bodies 4 that are dispersed inside of the organic solvent phase 8. The Figs. 3a and 3b display the stirring disk 12 in an enlarged manner. The stirring disk 13 possesses bent teeth 14 at its circumference.

Fig. 4 displays a grinding diagram with which the material that has been removed by the grinding process is shown in grams (g) on the ordinate, and the number of grinding periods to 23 each contacts is projected on the apses. The grinding process was executed during the first 6 contact periods in the following sequence and with increasing load forces (period 1 with 2.4 kg; period 2 with 3.0 kg; periods 3 and 4 with 3.4 kg each; period 5 with 3.8 kg, and period 6 with 4.5 kg). Starting with the 6th period the grinding operation was conducted with a constant load of 4.5 kg. The curve 1 in Fig. 4 represents the grinding work of a grinding belt that was equipped with sprinkled on grinding media in the form of ball shaped grinding bodies that possessed the sifting fraction of 750 to 1000 micron. The grinding bodies contained grinding particles of the grid size P120 that correlates with a median diameter of 125µ. The curve 2 displays a grinding belt that contained the grinding particles P 120 in the form of ball shaped grinding bodies that possessed the sifting fraction of 500 to 750 micron. The grinding bodies with a larger diameter are providing the higher material removal per time unit. The curve 3 finally displays the grinding output that is delivered by means of a

conventional grinding belt that was equipped in the known manner with the grid size P 120.

Example 1

Introduced into a stirring vessel that was equipped with a high speed stirring fixture were 550 ml benzene and they were heated to 60 °C. Subsequently, there were 100 grams of grinding particles (corundum) introduced that possessed a median particle diameter of 90 micron, and following this procedure a mixture that consisted of 10 grams of an ureic formaldehyde resin of the type HW 503 (Farbwerke Hoechst AG) were introduced at a stirring speed of 900 rotations per minute. One (1) gram of ammonia chloride, and 3 – 4 ml of water were added. Within 3 – 5 minutes ball shaped or elliptical grinding bodies started to be created from the single particles and the ureic formaldehyde resin. The benzene was separated from the thus created grinding bodies after 35 minutes, and said grinding bodies were dried at 70 – 80 °C.

The balls that are created in such a way possessed the relatively open structure that can be seen in Fig. 4, and single particles were present herewith in a non orderly fashion.

A grinding belt with fully artificial resin bonding was produced with the sifting fraction 500 – 710 micron. Herewith, a pretreated woven cotton substrate was coated with a phenol resole, the grinding bodies were sprinkled on to it, and subsequently, an other mixture consisting of phenol resole and filling material was coated over said layer. Following this process, the material was dried. Thereafter, the grinding belt that had a dimension of 50 x 2134 mm was used for test grinding on a contact belt machine that was equipped with an automatic work piece delivery, The work piece was an angular iron profile with the dimensions 20 x 3 mm of the quality St. 37. The total grinding process was conducted over 12 grinding periods with 23 contacts of a 10 second time duration each. During the first five grinding periods the load force was increased from 2.27 up to 3.77 kg, while a continuous load force of 3.77 kg was utilized during the grinding process of the last seven periods.

Compared to the common grinding belt a more than double as high amount of material was ground off with which the ground off amounts were practically identical during the individual grinding periods that were conducted under the identical applied load force. The grinding belt that was produced following the invention was not worn out yet after this experiment.

Example 2

Grinding bodies with the sifting fraction 840 – 1000 micron that possessed individual grinding particles (corundum) that had a median particle diameter of 180 micron were produced following the process according to example 1. The conditions for the test grinding process were the same as the ones listed in example 1. However, herewith the grinding process was conducted with an increasing load force of 2,27 up to 4.54 kg for the first five grinding samples, and subsequently for 16 further grinding samples the grinding was conducted with the highest load force of 4.54 kg. Herewith, too, a uniformly high amount of ground of material was achieved over the long time duration. In opposition to this, the conventional grinding belt that was utilized for comparison purposes was used up after 11 periods.

Example 3

160 kg of Shellsol A, together with 50 kg corundum (median particle diameter 90 micron = Fepakorn P 150) were introduced into a vessel that was equipped with a high speed stirring fixture. A mixture that consisted of 5 kg ureic formaldehyde resin of the type HW 503 (Farbwerke Hoechst AG), and 500g ammonia chloride that was dissolved in 1.5 l of water which was added at a stirring speed of 500 rotations per minute. After 10 minutes, the stirring speed was reduced to 300 rotations per minute. The stirring process took place at room temperature for a time duration of 90 minutes, and subsequent to said process, the Shellsol was filtered off. The ball shaped grinding material such created was washed with Frigen 113 TR-T, and it was dried and sifted following said washing process. As it is stated in example 1, a grinding belt was produced with the sifting fraction 500 – 710 micron, and said belt was used for test grinding processes. The grinding belt allowed to achieve a total material removal of 1114 grams, while the standard belt allowed for a total material removal of 314 grams.

Example 4

200 l per-chlorine ethylene and 100 kg corundum (median particle diameter 90 micron) were introduced into a vessel that was equipped with a high speed stirring fixture. A mixture that consisted of 10 kg ureic formaldehyde resin of the type HW 503 (Farbwerke Hoechst AG), and 500g ammonia chloride that was dissolved in 3 l of water was added at a stirring speed of 550 rotations per minute. After a time duration of 10 minutes, the stirring speed was reduced to 300 to 400 rotations per minute, and it was kept at a speed that ensured that the particles would not settle to the bottom of the vessel. The stirring process took place at room temperature for a time duration of 90 minutes, and subsequent to said process, the per-chlorine ethylene was drained of. The thus created ball shaped grinding bodies were dried and sifted. With the sifting fraction 500 – 710 microns, grinding belts that had a dimension of 100 x 4000 mm were produced The belts were used for a tip free round grinding process that is employed for the processing of pipes that possess a high nickel content. The dimension of the pipes was: 25 x 3, and 38 x 3 mm, the length ranged between 7 and 8 meters. An average of 20 pipes were ground with the support of conventional grinding belts that are made entirely on an artificial resin base. Subsequent to this process, the belts were removed because of the fact that the required material removal could be achieved anymore with said belts. A total of 90 pipes were ground with the belts that were produced according to the invention.

Example 5

Herewith, the same procedure is applied as in example 4, only the starting amounts will be increased.

250 l per-chlorine ethylene
150 kg corundum (90 micron)
15 kg binding medium
1.5 kg ammonia chloride dissolved in 4.5 l of water.

Grinding belts that possess a dimension of 100 x 3000 were produced with the sifting fraction 500 – 710 micron. The belts wer used for a tip free round grinding process that gets employed for the processing of pipes that possess a high chromium nickel content.

The dimension of the pipes was: 13 x 0.6 mm, the length was 6.5 meters. An average of 500 meters was ground by means of conventional grinding belts that are made entirely on an artificial resin base; 1310 meters were ground with the support of the belts that were produced according to the invention.

Attached herewith are 4 sheets of drawings

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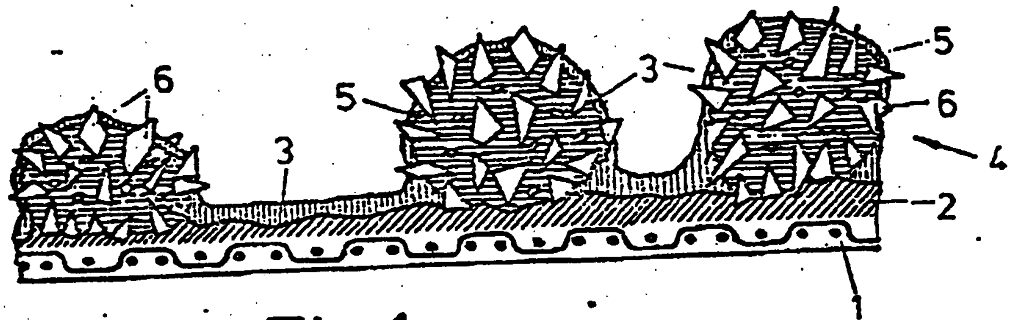

Fig.1

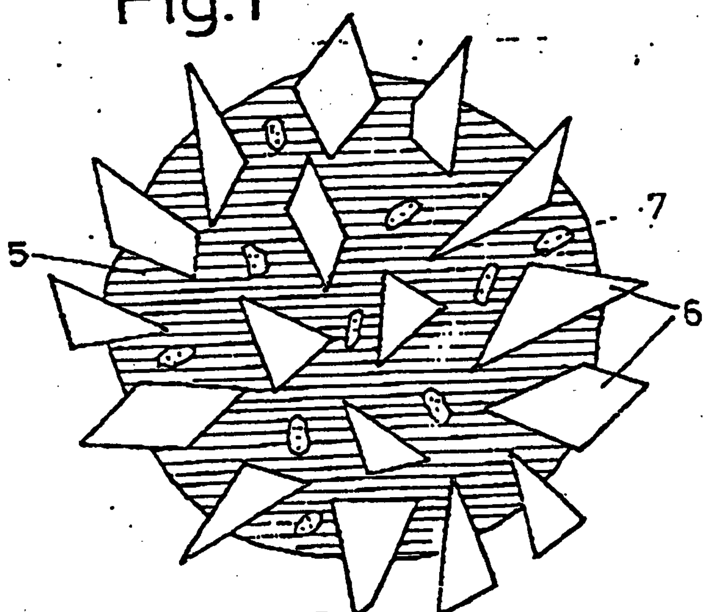

Fig.2

Nummer: 26 08 273
Int. Cl.2: B 24 D 11/00
Bekanntmachungstag: 22. Dezember 1977

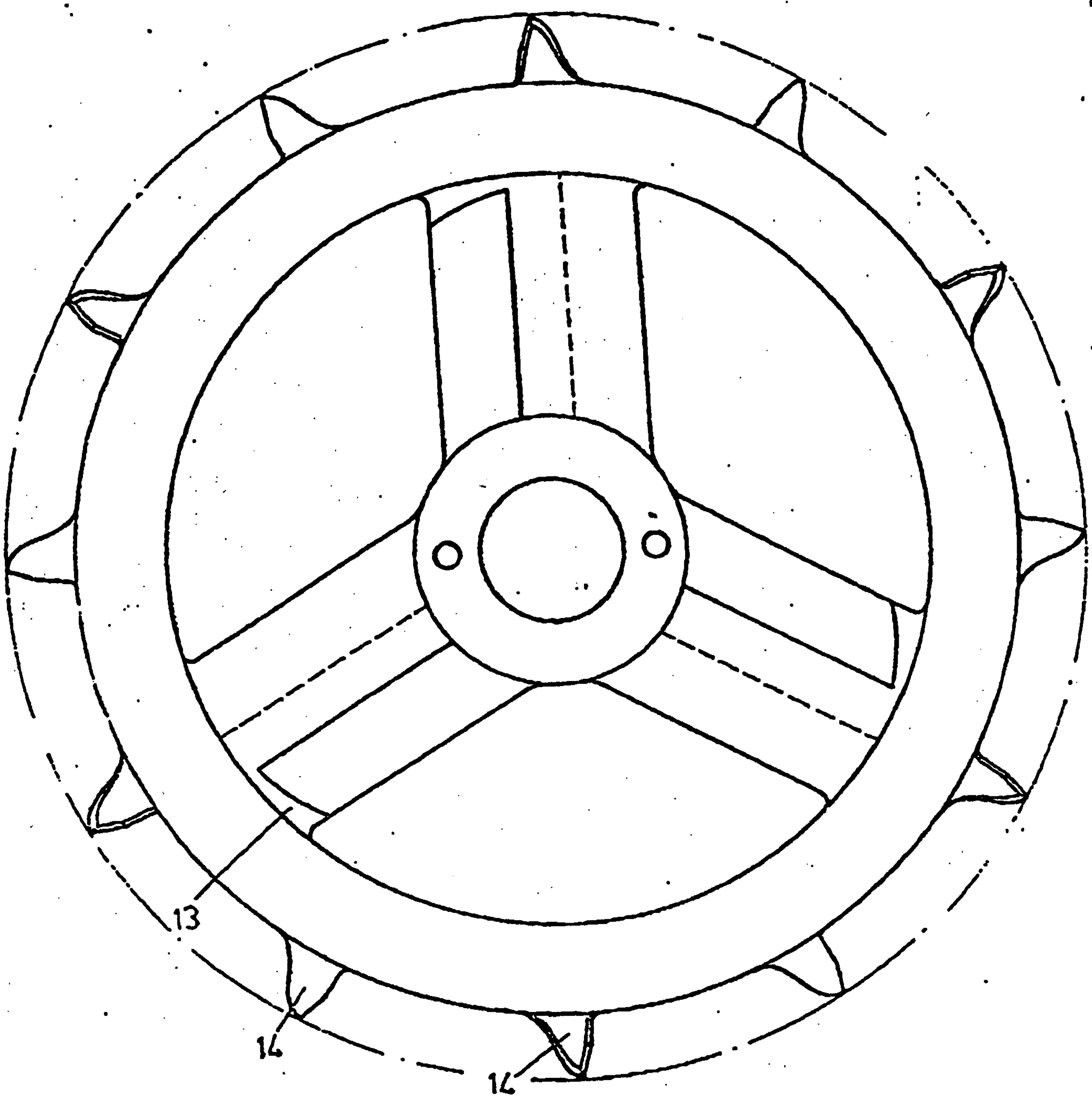

Fig.3a

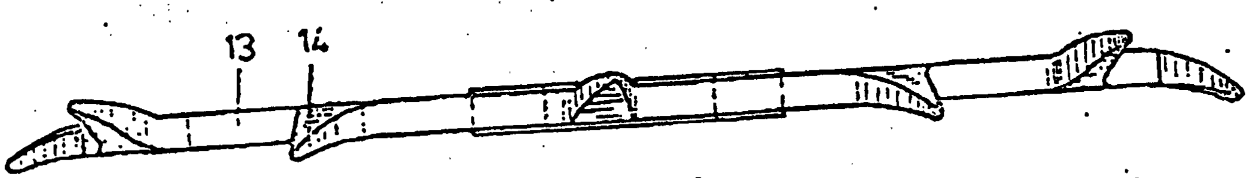

Fig.3b

Nummer: 26 08 273
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Bekanntmachungstag: 22. Dezember 1977

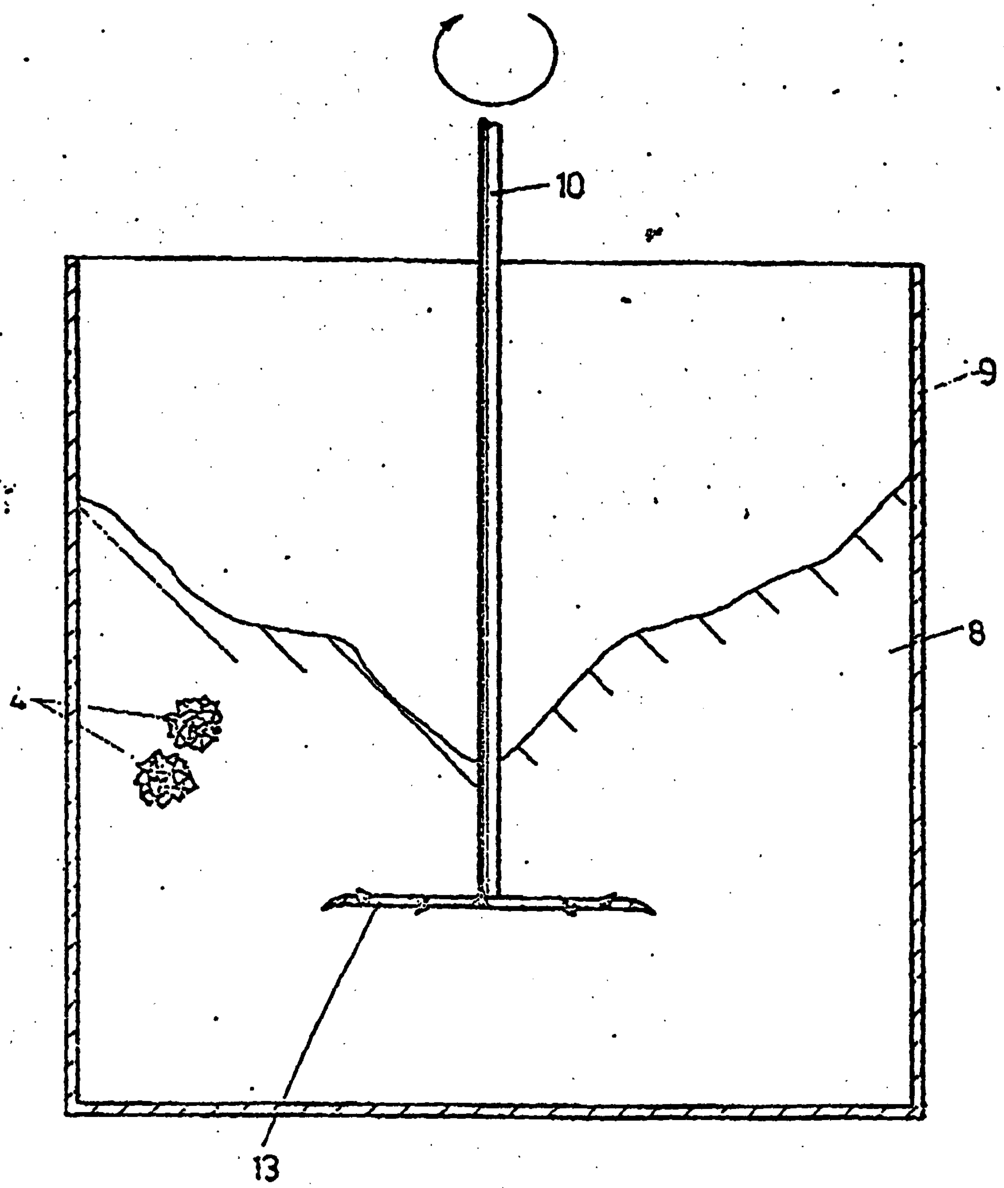

Fig.3c

...EICHNUNGEN BLATT 4

Nummer: 26 08 273
Int. Cl.²: B 24 D 11/00
Bekanntmachungstag: 22. Dezember 1977

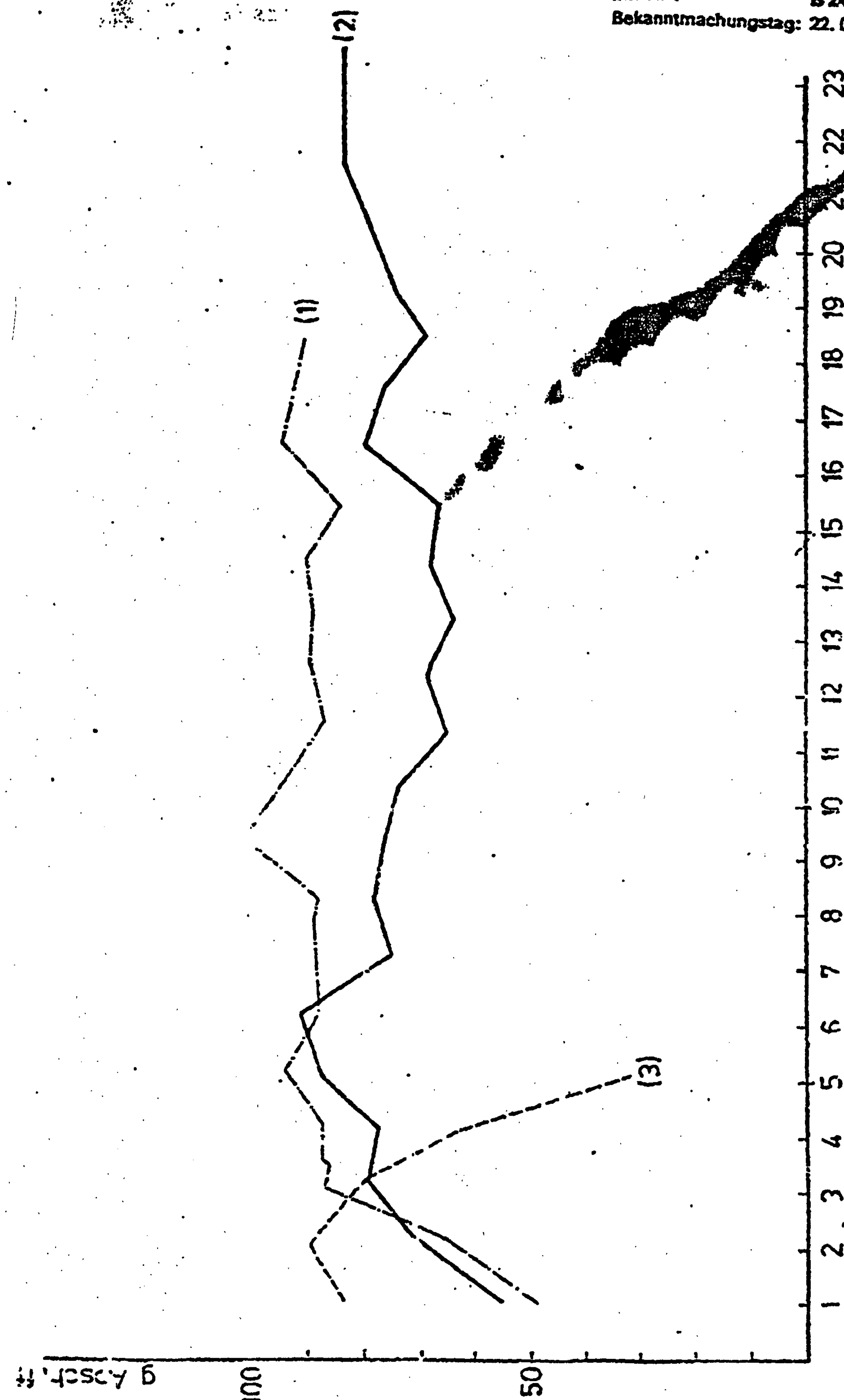

Fig.4